# Fireweed

Invasive Species Unit

Fireweed (*Senecio madagascariensis*) is a highly invasive and opportunistic weed native to south-eastern Africa. It quickly colonises overgrazed pastures and disturbed areas (Figure 1).

## Impacts

Fireweed is a serious pasture weed of coastal New South Wales (NSW). It is able to grow on most soil types and in all aspects.

It forms a persistent seedbank if not controlled before it flowers and can rapidly take over heavily grazed and neglected pastures, competing strongly with existing pasture plants. It seeds prolifically and grows to maturity quickly. Density is influenced by groundcover and competition, especially in autumn. Fireweed can quickly establish:

- where ground has been cultivated or disturbed, or
- where groundcover competition is reduced (Figure 8), for example in drought, or under excessive grazing pressure.

The population of fireweed in infested areas depends on seasonal conditions and varies from year to year. Fireweed infestations may:

- reduce the total grazing capacity of a property;
- decrease pasture production;
- decrease livestock growth rates; and
- incur high control costs.

## Identification

Fireweed is a daisy-like plant that grows from 10 to 60 cm high (Figure 2). It has a variable growth habit and leaf structure, but the most common form of fireweed is a low, heavily branched, annual or short-lived perennial plant.

### Leaves

Generally bright green in colour, fleshy and narrow, leaves are 2–7 cm long, alternately arranged on the stem, and have serrated, entire or lobed margins (Figure 4). Broader leaves usually clasp around the stem.

*Figure 1. Fireweed is an invasive weed of pastures along coastal NSW. Photo: N Griffiths*

## Flowers

Small, yellow and daisy-like, flowers are 1–2 cm in diameter and arranged in clusters at the end of each branch. They can number from 0 to 200 per plant, and each flower will commonly have 13 petals and 21 bracts forming the 'cup' under the flower (Figures 3 and 5).

## Seeds

Seeds are small (1–3 mm long), light and slender. They are cylindrical in shape and have a downy surface. They are attached to a pappus, consisting of fine, silky, white feathery hairs that aid in dispersal by wind.

## Roots

Fireweed has a shallow, branched taproot with numerous fibrous roots growing from 10 to 20 cm deep.

# Distribution and habitat

Fireweed is largely restricted to the south-eastern coast of Australia and has established along the entire NSW coast. First recorded in the Hunter Valley in 1918, it has spread south into Victoria and occurs as far north as central Queensland. It also occurs on the northern and southern tablelands of NSW and as isolated infestations in parts of inland NSW. While fireweed does occur on the southern tablelands and inland NSW, it is likely to be less invasive in these areas.

It grows on a wide range of soil types, from high fertility, self-mulching clay soils to low fertility, acid, sandy soils. It is most prolific in well-drained, lighter-textured, acid soils of low to medium fertility. It will not survive in poorly drained or waterlogged situations.

*Figure 2. Fireweed is a heavily branched daisy-like plant. Photo H Rose.*

*Figure 3. The 21 light green petal-like structures (phyllaries) that form the cup under the flower distinguish fireweed from other closely related species. Photo: B Johnston.*

*Figure 4. The serrated leaf margins of fireweed. Photo: H Rose*

*Figure 5. The small flower of fireweed usually has 13 petals. Photo: H Rose*

Fireweed does not grow well in shaded areas, preferring open country and areas of bare soil. It will quickly invade roadsides, pastures and open forests, and heavy infestations are common on cultivated or disturbed land.

A native plant with several subspecies of differing appearance (*Senecio pinnatifolius*), also known as variable groundsel, is sometimes confused with fireweed. More widely distributed throughout alpine, arid and coastal environments, it occurs in a range of climatic and geographical regions throughout Australia, except in the far northern areas, and is not considered a weed.

*S pinnatifolius* is mainly found in locations where the pest variety of fireweed is unlikely to grow, such as woodlands, bushland and undisturbed sites.

## Lifecycle

Fireweed is opportunistic and able to take advantage of changes in the environment. Under favourable seasonal conditions, the plant may behave as a short-lived perennial, with some plants surviving for 3 years. However, the majority of plants only live for one season.

On the coastal strip of NSW fireweed is capable of germinating, growing and flowering during most of the year. Most stages of the plant (seedlings to flowering) can be seen at almost any time of the year. However, most seeds germinate in autumn.

Germination depends on a combination of rainfall, light and temperature. Rainfall when the temperature is 15–27°C will produce flushes of new seedlings. Seeds are less likely to germinate if they are buried more than 2 cm below the soil surface. However, some buried seed may remain viable in the soil for up to ten years.

Once released from the flower head, many seeds can germinate immediately, and then several germinations can occur in one season if conditions are favourable.

*Figure 6. Fireweed seedlings germinate in flushes in response to significant rainfall events in autumn. These seedlings in a kikuyu pasture have produced their first pair of leaves. Photo: B Johnston.*

Plants grow quickly and can produce flowers 6–10 weeks after emergence, with flowering occurring mainly in spring.

Fireweed seeds profusely, with each flower producing between 50 and 120 seeds of high viability. One plant is capable of producing 5 000 to 30 000 seeds in one season depending on conditions. Most seed germinates quickly, but about 15% of seed has a high level of dormancy.

Fireweed usually begins to die off in the spring. However, in some plants, only the top of the plant dies back, leaving the base and roots intact over the summer. The plant may then quickly regrow from the crown the following autumn.

## Spread

The light fluffy seeds of fireweed are easily spread by wind. This is the main method of local spread. Most seed will fall within 5 metres of the parent plant but some seed can be spread to greater distances in updrafts and whirlwinds. However, the fluffy pappus is easily detached from the seed and what may appear to be fireweed seed blowing long distances on the wind may in many cases be only the detached pappus.

Dispersal beyond 1 kilometre is more likely to be caused by unintentional spread by human activity. Various means of spread include:

- livestock;
- clothing, vehicles and machinery; and
- contaminated hay, silage and grain products;
- spread by wild and feral animals.

## Livestock poisoning

Fireweed contains pyrrolizidine alkaloids that are toxic to livestock and cause liver damage. Young or hungry stock or new stock not previously exposed to fireweed are the most at risk of poisoning.

All parts of the plant at all stages of growth are toxic. Hay, silage or grain that is contaminated with fireweed plants or their seeds can also be toxic.

Pyrrolizidine alkaloids cause liver damage and this can result in a variety of clinical syndromes in livestock.

Symptoms of pyrrolizidine alkaloid poisoning include:

- loss of condition;
- poor growth rates;

- weakness;
- abdominal straining; and
- chronic scouring.

In cattle the most common problem is ill-thrift, sometimes accompanied by scouring, weight loss or failure to gain weight, and eventually death. Some affected cattle may also develop nervous signs due to brain damage.

Sudden deaths can occur in fat animals that are no longer grazing fireweed-infested pasture but have grazed them in the previous 3 to 6 months.

Sheep and goats are more inclined to eat fireweed than cattle and are up to 20 times more tolerant of pyrrolizidine alkaloids. Merino sheep are more tolerant than British breeds or crossbred sheep because they restrict their daily intake of the plant whereas other breeds will eat it to excess.

If a group of sheep are forced to eat fireweed over two or more consecutive years then some of them may become affected and present with chronic ill-thrift or sudden death. Liver damage in sheep and goats does not usually result in nervous signs.

Horses are more susceptible to fireweed poisoning than cattle or sheep. Affected horses can suffer brain damage and photosensitisation affecting unpigmented areas of skin. Brain damage results in signs of dullness, aimless wandering, an uncoordinated gait, pressing up against fences, gates or trees, reduced awareness, and possible blindness. Limited evidence suggests that alpacas are also susceptible to poisoning.

The liver damage caused by fireweed is irreversible and there is no antidote for toxic pyrrolizidine alkaloids. It is difficult to positively identify pyrrolizidine alkaloid poisoning as other conditions such as mineral deficiency and internal parasites can cause similar symptoms.

If you suspect that you have affected animals contact your veterinarian to exclude other possible causes and to obtain symptomatic treatment for the affected animals.

# Management

Management should include a variety of methods to ensure the best control of fireweed is achieved.

Management options will vary depending on the situation, with different approaches, for example, for grazing enterprises, environmental areas or small area holdings:

- for grazing enterprises, management may include using grazing strategies as well as fertiliser application at appropriate times, upgrading pastures, and strategic herbicide applications;
- for environmental areas, hand-pulling individual plants and using spot spraying for herbicide application may be more acceptable.

To ensure that the best control of fireweed is achieved, a thorough and systematic management program needs to be in place. It is also preferable to manage a small area correctly than to poorly manage a large area.

Whatever the situation, once established, fireweed is extremely difficult to eradicate. Therefore follow-up treatment is essential for control to be successful.

## Prevention and early detection

Early detection is vital to prevent fireweed from becoming established. Once fireweed is detected, it is important to act immediately to prevent the problem from becoming worse. A dense pasture cover will help to prevent fireweed from invading.

As fireweed can be spread by contaminated feed, vehicles and machinery, property hygiene practices are very important to reduce the spread of seed. When buying hay from known fireweed-infested areas ensure it is not contaminated with this weed. Check paddock hygiene of silage/hay producers before purchase. Infested produce should not be moved to uninfested areas. Within infested regions avoid moving contaminated produce to clean areas.

## Pasture management

For successful fireweed control in the long term, it is essential to maintain a vigorous perennial pasture, using fertiliser applications on existing improved or native pastures and matching grazing pressure to pasture growth to maintain a dense pasture. These measures, and allowing a moderate body of pasture litter, particularly in late summer and autumn, will reduce fireweed seed germination and suppress seedling growth and development.

If density, quality and vigour of pastures have declined then pasture improvement by sowing suitable competitive pasture species may be an option. Without competition, fireweed will be able to quickly germinate following rain in autumn and spring and will grow more rapidly than the remaining pasture species.

A good stand of autumn–winter pasture cover can suppress fireweed populations. This can be achieved by:

- sowing winter pasture species;

- allowing a standover of summer pasture feed; and
- growing combinations of winter and summer pastures.

In the face of severe ongoing drought, consider reducing overall stocking rates before pastures are overgrazed and the ground laid bare.

Pasture spelling can help to maintain a vigorous pasture and reduce fireweed establishment. Use rotational or strip grazing. Set stocking should be avoided as it encourages selective grazing and will reduce pasture quality over time and reduce pasture density during low rainfall seasons. Completely locking up pastures is generally not recommended but may encourage recovery of perennial pasture species in overgrazed paddocks.

The guiding principles of pasture management for fireweed control are to:

- maintain groundcover in autumn;
- allow perennial species to recover between grazing periods;
- maintain a competitive edge over fireweed, even during drought times (fireweed growth is also affected by drought); and
- maintain a balance between fireweed and other pasture species so that animals are not forced onto fireweed or other injurious species because there is nothing else to eat.

If fireweed is a problem in native and unimproved pastures, it is important to ensure the pasture has at least 90% groundcover.

Pasture management and improvement of native pastures may mean a loss of native species, and hence a loss of biodiversity in the pasture. Disturbance created when oversowing or renovating native pasture may lead to increased density of fireweed as the disturbance stimulates germination.
If considering this option, seek further advice as some pasture improvement in native pastures may be restricted by the Native Vegetation Act 2003.

In any pasture management program, it is important to monitor and maintain soil fertility so that the pasture grows vigorously and is competitive to weeds. Soil testing can be used to monitor soil fertility and to determine fertiliser requirements to maintain soil fertility at appropriate levels.

## Pasture improvement

Pasture improvement is better developed as a control method for fireweed for the summer-dominant rainfall zones north of Sydney than for the winter-dominant rainfall zones of the south coast.

*Figure 7. Pasture directly drilled with ryegrass competes strongly with fireweed. Photo: N Griffiths*

If a pasture has large patches of bare ground and desirable pasture species are being choked out by weeds, then pasture improvement is essential. Pasture improvement is relevant for both large grazing enterprises and small area holdings.

Suitable summer-growing pasture species include setaria, kikuyu, paspalum and Rhodes grass. These summer pastures can be managed during late summer and autumn to maintain groundcover that will help prevent fireweed seedlings from growing. Establishing these pastures requires careful planning and timely implementation, and it is recommended that fireweed is prevented from flowering for several years before pasture re-establishment is attempted. See ‘Eight steps to successful perennial pasture establishment’ on the DPI website (details in ‘References’).

Winter or spring-growing pasture species such as phalaris, cocksfoot, fescue, ryegrass, white clover and subterranean clover will compete directly with fireweed. South of Wollongong, phalaris, fescue and cocksfoot with Haifa white clover and subterranean clover have the potential to be a suitable perennial pasture species mix. This pasture combination is relatively slow to establish and may initially require selective herbicide treatment to control fireweed. Once established, phalaris and fescue develop into large, tussocky plants that provide direct competition to fireweed.

When a pasture becomes less vigorous it is important to correct the cause of the decline before upgrading or resowing the pasture. Problems such as soil fertility should be examined to ensure that a vigorous pasture can be established and maintained.

Fertiliser applications are necessary as part of a longer term pasture improvement program. Applying superphosphate fertiliser to disturbed areas during pasture establishment or renovation can encourage the growth of fireweed and other control methods need to be incorporated into the program.

Consult your local agronomist and refer to local sowing guides for specific advice on the most appropriate pasture species, fertiliser recommendations and pasture establishment techniques for your situation.

## Grazing

Cattle and horses normally avoid eating fireweed (and the pasture below it): this can favour the growth and competitiveness of the weed, increasing infestation. Grazing pressure needs to be matched to pasture growth and availability to avoid pasture decline.

Sheep and goats will eat fireweed: they preferentially graze the plant, and display a high tolerance to its poison, and have proven to be a simple, cheap and effective management method. To avoid stock health issues when fireweed is present, land managers should use a new group of animals each year and to limit the cumulative effects of fireweed poisoning not graze the same group on infested areas for more than two consecutive seasons.

Do not use breeding stock for fireweed control. Either Merino or goat wethers are the ideal control group, or, if this is not possible, British breeds or crossbred sheep.

Fencing, yards and other infrastructure may be required to successfully integrate sheep or goat grazing into a fireweed management plan, increasing costs if this infrastructure is not already available. Wild dogs may also limit the areas where sheep and goat husbandry are feasible.

Pastures contaminated with fireweed should not be baled or made into silage or hay.

## Chemical control in pastures

Herbicides are a safe and effective method of control as part of an integrated fireweed management plan. Use of herbicides does not stop the need to maintain or establish a competitive pasture.

The aim of herbicide treatment is to minimise the establishment of a large population of fireweed in autumn. The longer that fireweed plants live, the more seed they produce, and large amounts of seed lead to heavy infestations. A well-timed herbicide application can be very effective in reducing the density of fireweed infestation for more than a year (Figure 11).

There is a range of herbicides registered for fireweed control. Bromoxynil herbicides cause less damage to pasture legumes but are only effective against fireweed seedlings and immature plants. These herbicides should be applied in autumn soon after the peak germination period for fireweed

*Figure 8. Drought and overgrazing can seriously affect ground cover, leading to fireweed invasion after rain. Photo: J Betts*

has passed (see Table 1 and 2 as a guide). This is when the daily maximum air temperature falls to below 20°C, and damage to legumes is less likely to occur. Treatment at this time will both maximise the kill of seedlings and kill immature early season plants before they become too mature to be susceptible to the herbicide (Figures 9 and 10).

Herbicides that cause more damage to pasture legumes have a longer application window and can be applied in spring if necessary. These herbicides include Grazon® Extra and metsulfuron-methyl. In NSW the use of metsulfuron-methyl is allowed under APVMA permit PER13113, which expires on 30 September 2014: copies of the permit can be viewed on or downloaded from the APVMA website, www.apvma.gov.au

When applying herbicides for weed control in pastures, special care should be taken to check and adhere to stock withholding periods.

Herbicides registered for the control of fireweed are also listed in the publications Noxious and environmental weed control handbook (4th edition) and Weed control in lucerne and pastures which are available online at www.dpi.nsw.gov.au/weeds or from the NSW DPI bookshop, telephone 1800 028 374. For further information on appropriate registered herbicides consult the product label or enquire at your herbicide reseller.

## Hand weeding

Hand weeding (removing individual plants) is appropriate when infestations are very small or isolated, and can be a useful form of control in environmental areas. Wear gloves when hand weeding.

Even after being removed from the soil, fireweed is still toxic to stock, and if it is flowering, it can still produce viable seed. All parts of the plant, especially the flowers, should be bagged and destroyed appropriately.

*Figure 9 (left). Fireweed seedling at the 5 to 6 leaf stage. Figure 10 (right) Fireweed seedling at the 8 leaf stage. Photos: B Johnston.*

*Figure 10. Well-timed application of herbicide can dramatically reduce the severity of fireweed infestations. This is a kikuyu-based pasture in the Bega Valley, NSW. Photo: B Johnston*

## Cultivation

A large proportion of areas infested by fireweed are non-arable due to slope or soil type.

For arable areas, cultivation followed by a cropping program with a forage cereal such as oats can be effective as part of a pasture improvement program. Cultivation in March and April can stimulate a large proportion of the seedbank to germinate. These seedlings can then be controlled with a knockdown herbicide or further cultivation before sowing the forage crop. (Avoid over-cultivation, which increases the risk of erosion.)

Consult an agronomist for further advice before using this method to control fireweed.

## Slashing/mulching

Repeated cutting, typically at less than six week intervals, can reduce, but not eliminate, fireweed production and seeding. However, while it controls fireweed, this technique is also damaging to the pasture, and should only be considered where the pasture will rapidly recover and out-compete any seedlings.

Fireweed should not be slashed in late spring or when more than 25% of plants present are still flowering, because mature plants that might otherwise have died may be encouraged to re-shoot and carry on into a second season.

A danger of slashed or mulched fireweed is that it wilts and becomes more attractive to stock, which may increase the risk of livestock poisoning. After slashing or mulching, fireweed-infested paddocks should not be grazed for at least two weeks.

## Biological control

There are currently no effective biological control agents for fireweed. Agents that have been tested were either ineffective or had an unacceptably large host range, including the closely related native *Senecio pinnatifolius*. The *Commonwealth Quarantine Act 1908* and *Environmental Protection and Biodiversity Conservation Act 1999* require biological control agents to be host-specific, and, since there are more than 30 native *Senecio* species in NSW, it is a considerable challenge to find a biological control agent that is highly damaging to fireweed, yet harmless to the native species.

Various naturally occurring diseases and insects have been found attacking and sometimes destroying fireweed plants. The most damaging insects are the chrysomelid beetle (*Chalcolampra sp*.), whose larvae and adults defoliate the plants; and two native moths:

- magpie moth (*Nyctemera amica*), which may defoliate plants, and
- blue stem borer (*Patagoniodes farinaria*), which may ringbark plants causing plant death.

These insects tend to damage plants late in the season after many seeds have matured.

*Figure 12. Yellow-rust fungus (Puccinia lagenophorae), shown here in its early stages, is a major killer of adult fireweed plants during warm, humid conditions. Photo: B Johnston*

Other insects which feed on firewood but do not appear to cause a lot of damage are a stem-mining fly (*Melanagromyza seneciophila*); a leaf-mining fly (*Chromatomyia syngenesiae*), commonly known as cineraria leafminer; two gall-forming fly species: *Sphenella ruficeps*, which form galls in flower heads, and *Trupanea prolata*, which forms galls in stems and flower heads; and two seedhead-feeding bugs, *Nysius clevelandensis* (commonly known as grey cluster bug) and *Nysius vinitor* (commonly known as Rutherglen bug).

In wet conditions the rust *Puccinia lagenophorae* (Figure 12) may damage or destroy plants. Another disease, *Albugo tragopogonis*, sometimes forms blisters on fireweed.

All these insects and diseases are also present on the closely related native *Senecio pinnatifolius*.

## Legislation

Fireweed is a Class 4 noxious weed in 18 local government areas of NSW under the NSW


*Figure 13. Areas of NSW where fireweed is declared a Class 4 noxious weed.*

*Noxious Weeds Act 19*93. The growth of the plant must be managed in a manner that reduces its numbers, spread and incidence, and continuously inhibits its reproduction.The responsibility for the control of noxious weeds on private land rests with the land owner or occupier of the land.

*Table 1. Suggested herbicide management strategies for areas south of Sydney.*

| **Month** | Jan | Feb | Mar | Apr | May | June | July | Aug | Sept | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plant growth stage** | Dead | Increasing germination events and seedling establishment, with most plants established by end of May. | | | | Seedlings established growth (slow growth in July) towards flowering. | | | Flowering and senescence | | Death | |
| **Herbicide use** | Avoid herbicide use | | Bromoxynil and Jaguar® most useful in pastures with legumes. Metsulfuron - methyl suitable for pastures without legumes. | | | Bromoxynil effective on rosettes, won't damage pasture legumes. Metsulfuron-methyl suitable for pastures without legumes. | | | Herbicide use not ideal, earlier kill preferred, however Grazon® Extra, metsulfuron-methyl and Hotshot® (spot spray only) can be used to target flowering plants. Success and evaluation period; plan implementation strategies for next year. | | | |
| **Notes** | | | Herbicides effective up to the end of July rapidly decline in effectiveness up to the end of August | | | | | | Generally too late for herbicides | | On-farm planning for next autumn | |

*Table 2. Suggested herbicide strategies for areas north of Sydney.*

| **Month** | Jan | Feb | Mar | Apr | May | June | July | Aug | Sept | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plant growth stage** | | Increasing germination events and seedling establishment, with most plants established by end of May. | | | | Seedlings established and growth towards flowering and maturity. | | | Can have either large flowering plants and new seedlings. | | Some plant death | |
| **Herbicide use** | Save herbicides for next period to control large numbers of seedlings. | | | | | Bromoxynil and Jaguar® most useful and cost-effective on small plants. May damage legumes if temperatures greater than 20°C. Optimum time to apply is June or July. Metsulfuron-methyl suitable for pastures without legumes. | | | Herbicide use not ideal, earlier kill preferred, however Grazon® Extra, metsulfuron-methyl and Hotshot® (spot spray only) can be used to target flowering plants. | | | |
| **Notes** | | | Herbicides effective up to the end of July rapidly decline in effectiveness up to the end of August | | | | | | | | On-farm planning for next autumn | |

## Further information

For further information on identification and control of fireweed, contact your nearest council weeds officer or agronomist. For further information on fireweed poisoning, contact your private or Livestock Health and Pest Authority district veterinarian.

## Acknowledgements

This Primefact is an updated edition of Primefact 126 *Fireweed*, December 2005. Authors: Hugh Allan, former Liverpool Plains Project Officer, Tamworth; Terry Launders, Senior Research Agronomist, Taree; and Keith Walker, Veterinary Officer, EMAI Menangle, authors of Agfact P7.6.29 Fireweed.

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ISSN 1832-6668



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Users of agricultural or veterinary chemical products must always read the label and any permit, before using the product, and strictly comply with the directions on the label and the conditions of any permit. Users are not absolved from compliance with the directions on the label or the conditions of the permit by reason of any statement made or not made in this publication.

**Pasture improvement cautions**

Pasture improvement may be associated with an increase in the incidence of certain livestock health disorders. Livestock and production losses from some disorders are possible. Management may need to be modified to minimise risk. Consult your veterinarian or adviser when planning pasture improvement.

The *Native Vegetation Act 2003* restricts some pasture improvement practices where existing pasture contains native species. Inquire through the NSW Office of Environment and Heritage for further details.

Published by the Department of Primary Industries, a part of the Department of Trade and Investment, Regional Infrastructure and Services.

Primefact 126 (second edition)

PUB12/82
First published September 2009

NSW GOVERNMENT | Department of Primary Industries